

EDITED BY J. HAY TAYLOR.

Price One Penny.

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IMMEDIATELY after a flash-light picture had been taken of the members of the London and Provincial Association, by means of Mr. J. G. Hudson's new lamp, on 12th ult., a policeman's whistle was suddenly heard, and within a few minutes a fire-escape, engines, and the usual crowd accompanying such, brought up below the open window from which the smoke from the magnesium was escaping. For a few minutes there was great excitement outside; but it gradually simmered down when the cause of the bright light and smoke was explained.

* * *

SPEAKING of fires; a house in a well-known town in the North-west of England recently took fire; in one of the rooms was a fully charged cylinder of oxygen, which exploded by the action of the heat. Parts of the cylinder were afterwards picked up in an adjoining street.

* * *

It may not be generally known that cylinders are slightly larger when filled with compressed gas than when empty, and instances have been known of a charged cylinder refusing to go into a box which fitted it accurately when empty.

* * *

A WHOLE chapter of accidents happened early last month at a well-known scientific institution in London. A scientific lecture was announced and the operator was lighting up his lantern, when the 4½ in. condenser cracked. A messenger was at once dispatched for another, but one of 4 in. diameter and of unsuitable focus was brought

back, then a cab had to be sent three miles in order to make sure of getting the correct size. In the meantime the light was being got in readiness when the regulator broke down, a messenger was sent for another, but he brought back one that had a different screw and consequently would not fit the cylinder, and eventually another cylinder had to be obtained to fit the regulator. After three-quarters of an hour delay from the announced time of commencing, the lecture and illustrations were given without further mishap.

* * *

THE sixth annual exhibition under agreement between the photographic societies of Philadelphia, New York, and Boston, will be held from 17th to 29th April, at the galleries of the Pennsylvania Academy of Fine Arts, Philadelphia. The exhibition is open to all photographers of the world, and all correspondence should be addressed to Mr. R. S. Redfield, 1601, Callowhill Street, Philadelphia, U.S.A.

* * *

THE Photographic Club gave two entertainments within the last few days. On the 25th ult. a musical and lantern entertainment was given to members and their friends, under the direction of Mr. F. A. Bridge, and two days later a juvenile entertainment was given to members' children, at which the lantern and refreshments played a prominent part.

* * *

AN exhibition of photographs and apparatus will be held by the Blackheath Camera Club at the "Hare and Ant," Blackheath, on March 3rd and 4th, when medals will be offered in seven different classes. Particulars of which can be obtained from the Hon. Sec., Mr. C. W. Piper, A.R.I.B.A., 46, Shooter's Hill Road, Blackheath, S.E., on or before 22nd inst.

* * *

THE National Lantern Slide Exchange, with headquarters at 20, Parsonage, Westleigh, Leigh, Lancs., is a Society that has for its purpose the exchange and loan of slides. Members pay 10/6 per annum; deposit sets of not less than fifty slides, and take others on loan from the general pool.

* * *

THE editor (Mr. W. D. Welford) of *Photographic Review of Reviews* has removed from Birmingham and opened an office at 57 and 58, Chancery Lane, London, W.C.

* * *

WHEN in Birmingham several months ago Mr. Wm. Tylar took us to see some new premises

he had purchased at 41, High Street. Since that time the workmen have been at work there making certain additions and alterations, and these having now been completed, Mr. Tylar has removed from his old address to the new place which is only a few doors away, but which will afford more room for his increasing business.

* * *

MR. E. H. STEVENSON, whose name is familiar to our readers, gave a lecture on London (120 slides) at the Assembly Hall, Norwich, on 12th ult., the prices of admission were only 2d. and 3d., and as may have been expected the hall was crowded. Mr. Stevenson is described by those who were present as an able lecturer, humourist, reciter, and preacher combined.

—:—

The Practical Management of a Triple Lantern.*

BY C. GOODWIN NORTON.

THE object of this paper is principally to give a few hints relative to the management of a bi-unial and triple lantern, also to explain how some of the difficulties attending such may be overcome, to show the respective merits of jets used with various makes of oxygen, the effects upon the screen of a good and bad condenser, and to show a simple method of testing lantern lenses.

It would be practically useless to show what can be done with apparatus specially constructed at great cost for a particular purpose, therefore, the lanterns used are of the ordinary type, and in the case of the slides to be used to illustrate the various points no special selection has been made excepting a few drawings especially relating to this lecture.

It would be of little use in this case to show the ordinary lanternist what can be done with a certain apparatus if that apparatus cannot be obtained for less than £80 or £100.

When preparing a lantern for exhibition it will be found a good plan, especially for those who only occasionally give entertainments, to make a list of every article that can possibly be required, as the absence of any one article may seriously delay the exhibition, or, perhaps, prevent its being given. Many of the items may seem unnecessary, but they cost little, occupy small space, and save a deal of anxiety to the operator.

* Lantern Society.

The following list is specially intended for the mixed jet:—

ARTICLES MOSTLY REQUIRED WHEN MIXED JETS ARE USED.

Lantern and Rolling Curtain. Condensers. Objectives. Lengthening Tubes. Jets in Lantern. Dissolver, if moveable. Spare Jet. Oxygen bottle and right hand connector and regulator. Hydrogen bottle and left hand connector and regulator. Quantity of gas in bottles.....feet. Key Wrench. Pressure Gauge. Rubber Tubing. Hard Limes. Lime Tongs. Thumbscrew Elevator. Slides, including Curtain, Good Night, Regulating Templates, Carriers, &c. Tinting Glasses. Opera Glasses. Screen, Frames, Rope, Twine, and 6 Screw Eyes. Hammer. Driving Hooks. Nails. Gas Pliers. Wedges. White Lead. Matches. Curtain for stand. Reading Lamp and Signal. Lecture. Music. Duster. Wash Leather. File. Special Articles.....

The list of articles which may be required when using the blow-through jet is longer.

LIST FOR BLOW-THROUGH JET.

Lantern and Rolling Curtain. Condensers. Objectives. Lengthening Tubes. Jets. Spare Jet. Dissolver, if moveable. Gas Bottle. Regulator. Connector. Quantity of gas in bottle.....feet. Key. Wrench. Rubber Tubing. Pressure Gauge. Limes. Lime Tongs. Thumbscrew. Elevator. Slides, including Curtain and Good Night. Carriers. Tinting Glasses. Opera Glasses. Curtain for Stand. Screen. Frame. Rope. Twine. 6 Screw Eyes. Hammer. Gas Pliers. Burners. Adapter. Diminishing Sockets. Nose Piece. Nails. Wedges. White Lead. Soap. T-piece. Plugs. Tubes to connect rubber tubing. Reading Lamp and Signal. Lecture. Music. Matches. File. Special Articles.....

REGULATOR FITTINGS.

Regulators are screwed on the bottles or cylinders containing the compressed gases to supply the gas to the lanterns at a uniform pressure, and as the bottle containing the hydrogen often has a thread of the opposite direction to that containing the oxygen, just imagine the difficulty that would occur if we have the wrong handed connector or regulator, or no regulator, and the gas cylinder fitted with Brin's female threaded valve. It would be hopeless for a non-mechanical person to attempt to give the exhibition. Something might perhaps be done with a piece of tube and a cork, but the chance of getting a good light would be very remote.

HOUSE GAS.

The operator who uses the blow through jet would, of course, previously ascertain whether

house gas is available at the place of exhibition.

Many houses are now lighted with electricity and have no gas on the premises, and in some public halls the burners are placed in a position to be quite useless to the operator. These are practically the only drawbacks to the use of the blow through jet, which for private houses is the best and easiest for amateurs to use.

The light given by this form of jet has been stated on good authority to be equal to illuminating a 15ft. picture at a distance of 40ft.

SIZE OF PICTURES.

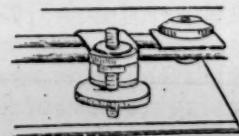
Leaving the erection of the screen as beyond the present purpose, the next thing to consider is the size of the picture under various circumstances. Most amateurs endeavour to get as large a disc as possible, which may perhaps be all very well for those who sit at the back of the room, but not for those who sit in front, for in order to see, say, a 20ft. picture in comfort, one must be at least 20ft. from it.

The best size for a picture is the smallest that can be distinctly seen from the back of a room, and the same rule governs its height from the floor, it should be as low as possible, provided all can see comfortably.

CENTERING THE LIGHT.

When lighting up the lantern, the greatest care should be taken to get the light properly centered, especially is this the case when lenses of long focus are used in conjunction with mixed jets.

A clamp of some kind should be employed to secure the front part of the jet. The simpler the better, and perhaps the style shown is both the simplest and the best. Many elaborate



arrangements for the purpose are sold, but elaboration only adds weight and cost to the lantern outfit; besides, when once the light is centered it is seldom required to be moved from its place for an ordinary exhibition.

When the light is moved, dark shadows will appear on various portions of the disc according to the direction in which the light is moved from its centre.

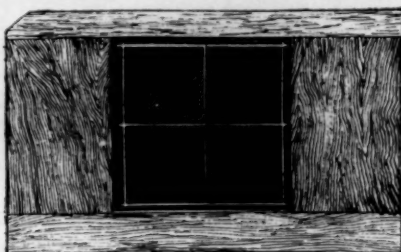
Sometimes it is impossible to get the disc evenly illuminated all over, no matter where the light may be placed, this is the fault of the condenser not being suitable to the focus of the objective. The remedy is, generally, to get a condenser of longer focus, or, the two halves of

which the condenser is formed may not be mounted the correct distance apart, and this necessitates its return to the optician for the purpose.

COINCIDENCE OF DISCS.

Having lighted up the bi-unial or triple lantern, beginning with the top one, the next thing is to make the discs coincident. This it is impossible to do exactly, as the bottom edge of a square slide shown at the top lantern must be a little larger than the top edge, as the light strikes the screen obliquely, and the error is doubled by the bottom lantern, but they can be got near enough for practical purposes if a lens of long focus be employed, and the longer the focus of the lens, the less apparent is the error, but it always exists.

Before adjusting the discs the objectives should be exactly focussed, which is best done by using a lens tester in place of an ordinary slide, which will at the same time indicate whether the lens is capable of giving sharp definition all over the disc, or what is known as flatness of field. A lens tester is a slide that is



known to be absolutely sharp up to the very edges, and to ensure such I find the best slide to use is one composed of a piece of Brussels net stretched between two pieces of glass. This is much better than using a photograph of a hymn or a map, as we have no guarantee that the lens with which the photograph was taken was capable of giving flatness of field.

In order that pictures placed in the stages of two or more lanterns may register perfectly upon the screen the lenses employed must be of the same focus, and this can be ascertained by placing in each lantern "template" slides as shown. These templates must be exact in every particular. They are made by a mechanical process acting not unlike the slide rest of a lathe; the glass portion being first glued into the wooden frame, and the lines then traced on the prepared glass by means of a point. By this method all are identical.

REGISTRATION OF EFFECTS.

We are now approaching a very delicate matter—the registration of effects. Several manufac-

turers claim that their respective method of doing this is the best, in fact, the only correct method, and impart their secret only to purchasers of their apparatus. Some claim that elaborate apparatus is required to effect this, whilst others state that their lanterns are quite correct before they leave their premises. There is something to be said on both sides. If the lantern is to be used always at one place and at one distance from the screen, the stages and stops when once adjusted would not require to be altered, but, unfortunately, no two places of exhibition are alike, and besides, the brass work of a lantern front is liable to give to a slight extent unless made immensely strong and heavy. A slight adjustment of the runners and stops is, therefore, sometimes necessary, and unless these are made moveable, the lantern will require to be sent to the maker to be re-adjusted every time it happens to get a knock or jar at the hands of one of the large army of careful railway porters.

SIZES OF FRAMES.

Unfortunately, many of the stages of lanterns are made so small that there is not enough room to fit runners, and at the same time leave sufficient space to allow of the usual $4\frac{1}{2}$ in. carrier or frame to be used. Those exhibitors who frame all their slides can have them 4 in. wide, but others who from necessity or choice use sliding carriers must have the frames of their effect slides $4\frac{1}{2}$ in. wide, which makes them heavy and cumbersome, unless a carrier is made from an ordinary frame with a slot in the top, which in some respects is more convenient than a sliding carrier.

RUNNERS.

To return to the runners, the shape of a simple and effective one is here shown. The lanternist having made up his mind as to which width of frame he will use, it will be obvious that the runner will only be required to be raised a very little, say not more than $\frac{1}{8}$ in. at one or both ends, to act as fine adjustment to the hinges of the lantern plates. This runner is sufficient to effect this, and in the simplest manner possible, by manipulating the



screws. The top screw of the lower sets pressing against the pillar of the stages will raise the runner to the extent of $\frac{1}{8}$ of an inch if necessary, and when in its correct place it can be clamped by the lower screws. By placing

the templates in the stages and slightly manipulating these screws the effect will be apparent.

It is necessary that the runners must be parallel to the hinge on the front of the lantern, and this can only be done by trying them with templates which are known to be correct, the lantern itself having first been set on a perfectly level surface.

Once the horizontal lines of the templates have been got to agree, it is a simple matter to adjust the side stops, so that all the lines will coincide, some little allowance being made for the error previously mentioned. This, combined with the lens tester, is one of the best methods for the amateur to test his objectives, as he can thus form an opinion for himself irrespective of what the maker or dealer may tell him.

FRAMING THE SLIDES.

We will now take it for granted that the lantern has been corrected; the next difficulty that presents itself is the slides. Some effects, such as slides showing a view by daylight and moonlight must be fixed in the frames by glue, as no method of wedging them in their frames will secure them against the possibility of slightly shifting.

A good means of testing the exactness of a set of such effects which may have been obtained "ready registered" is by means of a long toothed carpenter's gauge, which is used in the manner of a pair of compasses, the final adjustment being afterwards made by taking a little off the edges or end of the wooden frame by means of a plane and shooting-board, at the time they are tried in the lantern. If the amateur makes his own slides a fine line can be drawn round the negative, this will show in the slide, which must be glued in the frame before being coloured. Compared with a landscape which has no definite lines in the picture it will be an easy matter to make these lines agree. The mat and cover glass can be easily fixed on after colouring.

Should by any means rather too much be planed off the slide a piece of thin wood will be required to be glued on the frame.

When planing the frames of effect slides it is important that too much be not taken off one end, as by this means they may be thrown out of the perpendicular, and this is especially difficult to ascertain when there are no definite lines in the picture. By placing the effect slides in the lantern and suddenly changing them on the screen, the picture so changed will appear to partially revolve if they are not quite upright.

Enough has been said to show that there is no mystery in the registration of effects, it is only

a matter of care and patience, and the possession of suitable apparatus. One great source of annoyance is the mats, these are made in all shapes and sizes, and if metal masks are used in the lantern for the purpose of cutting all down to one definite size we should have no square pictures—a shape which suits some subjects better than circular mats—as some pictures must of necessity be round or oval as the original drawings happen to be that shape.

Before leaving the subject of registration, it may be as well to state that it is necessary to have the slides and lantern within $\frac{1}{100}$ th part of an inch to approach anything like perfection, as a picture 12ft. in diameter enlarges a slide something like 500 times, and an error of $\frac{1}{100}$ th part of an inch in the slide would represent upon the screen an error of about $\frac{1}{2}$ an inch.

DISSOLVING (BI-UNIAL).

Bi-unials are usually fitted with a dissolving tap, by means of which the supply of gas in the bottles can be turned off or on to one or both lanterns as desired, by merely moving a lever.

The usual pattern is that of the star six-way dissolver, and should be connected by means of rubber tubing to the four taps of the jets, in such a manner, that when the right hand of the lever is as high as it will go, the service of gas will be conducted to the top lantern, when at the bottom to the bottom lantern, and to both when midway. There is no direct method of turning off both lights with this dissolver.

There is, however, another pattern of six-way dissolver which will completely shut off both lights. In some cases each jet is fitted with a separate cut-off, but to me this seems unnecessary expense, as two taps fitted to the supply pipes will cut off the two jets at the same time. Such taps will be found very useful to save the gas in a short interval without altering the jet taps in any way which necessitate re-adjustment when again lighting up. These cut-off taps are also a means of safety when gas-bags are employed, for should the pressure boards be in danger of being turned over, as has been known to be the case, the gas can be promptly turned off. I would, however, give one word of caution when using them with a blow-through jet—operators have been known to turn off the hydrogen tap and forget all about turning off the supply at the supply pipe of the house main, for unlike when using cylinders, there is no noise caused by the escaping gas.

Another method for dissolving with a bi-unial lantern is to have a separate dissolver for each half of the lantern, but there is little or no gain in the system, as two levers have to manipu-

lated. When separate dissolvers are used they are best fixed to the lantern and not to the jet, unless the lantern is especially secure in its position.

DISSOLVING (TRIPLE).

With a triple lantern the dissolving arrangements are necessary somewhat more complex. There are, strictly speaking, only two systems of dissolving, and there are single plug dissolvers which combine the advantages of both.

With three four-way taps any or all the lanterns can be turned off or on in any desired rotation, and the rubber tubing for connections can be both short and compact, the only disadvantage being that two levers must be manipulated. Another method is to fit a six-way dissolver to two of the lanterns, and a four-way one to the third, which is used for effects. The advantage of this system is, that it is necessary to manipulate one lever only for dissolving, the third lantern being reserved solely for effect slides, such as a snow storm, or the moon being made to appear on a scene; but with this system there must be extra length of rubber tubing.

Care must be taken to get each slide in its proper lantern, say, in such a set as the cavern scene in *Gabriel Grubb*; this slide should be placed in the lantern reserved for effects, and the scenes dissolved on with the bi-unial portion connected with the six-way dissolver, the light meantime being subdued in the cavern scene so as to show up the effects in a pronounced manner.

Several attempts have been made to combine the advantages of each method by coupling the dissolvers together so that the movement of one lever will effect the other, also by having what is termed the one block system—that is, all the dissolvers in one—but this necessitates a perfect labyrinth of tubes, which, unless one is thoroughly experienced and in good practice, is confusing. If by chance two tubes were blown off, a large amount of study is necessary to replace them correctly, but if one keeps a plan or sketch beside him it is greatly simplified.

The particular system of dissolving, which the operator may decide upon, will in a large measure be governed by the nature of the slides he intends exhibiting and his skill in manipulating. In the course of my experience I find that one four-way and one six-way dissolver, possesses the most merits for an average exhibition; but if many effects are introduced then I prefer the three four-ways, whilst if the same operator is always at the lantern, the block system may be employed, but the particular system is in a large manner governed by choice and the experience of the operator.

GAS MIXING AT DISSOLVER.

There is always a liability with ordinary star dissolvers, that the gases will mix round the plug, which will sometimes cause the tubes to be blown off, but fortunately this usually happens whilst the lantern is being got ready and before the exhibition commences, and does little damage besides startling the operator and those near him.

From the opening remarks it might be thought that high-priced apparatus was unnecessary, but it must not be thought for a moment that slovenly or bad workmanship can be tolerated. There is no part of a lantern, including the optical part, in which greater care is required, that in the manufacture of the mixed jet and the regulator. A defect in the optical part, is a mere trifle compared to the havoc that may be caused from a defect in the construction of jet and regulator.

I once bought a jet which was as badly constructed as it was possible to be. The tubes, instead of being screwed into the chamber, were merely placed in holes and a little solder run round them. I used one, but about three minutes after the exhibition began, the solder melted, and the chamber dropped to the bottom of the lantern, and but for the fact that I had a spare jet with me, the exhibition could not have been given.

TESTING REGULATORS AND CYLINDERS.

With respect to regulators themselves it is hardly necessary to say much; the manufacture of these, so far as the South of England is concerned, is at present in the hands of three well known manufacturers. It is advisable, and it is money well spent to send them to be examined and tested periodically by the makers, who will do this for a small fee. The same may be said with reference to the gas cylinder, which should be tested at least once a year.

Nothing has been mentioned about gas-bags because now that we can get such good and cheap compressed gas, it may be safely predicted that they will shortly be a thing of the past. Excepting perhaps with lecturers who are constantly travelling in remote parts.

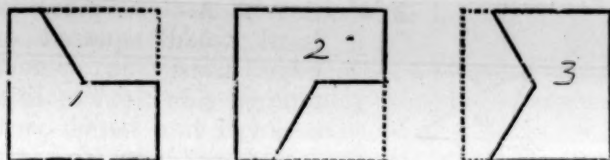
QUALITY OF OXYGEN.

Of late the questions of quality of oxygen has been to the front, and some may find it a difficult matter to readily determine their relative effects upon the screen.

Supposing one is desirous of comparing, say, three different makes, a simple method is to place in front of the condensers of a triple lantern a cardboard from which one-third has been cut out, as shown. These cards can be

so placed that the one-thirds from each lantern will form a disc so that the relative qualities of the oxygen may be considered. Of course, out of fairness, the tubes from each supply must be tried with each jet and not with one only, as no two jets are exactly the same.

The cards referred to can be cut as in 1, 2, and 3, this will give an equal space to each on the screen.



SUBSTITUTES FOR LIME.

It sometimes happens that one's stock of limes becomes exhausted, in which case, a tobacco pipe, chalk, and various other substances can be employed as a stop-gap, even an oyster shell can be utilised for the purpose. This can readily be adjusted in position especially if there be ladies among the audience, for a couple of hair-pins make an excellent support when suitably bent.

GENERAL HINTS.

The usual way when commencing a lantern entertainment is to flash the curtain slide on the screen from the middle lantern of a triple, the rolling diaphragm being racked sufficiently high to clear it. Next turn on the top lantern, the slide in which is covered with the diaphragm, this diaphragm is now lowered until the curtain on the screen has disappeared.

With a bi-unial, the slide in the bottom lantern would now be covered, and can only be released by rolling the second picture or having a supplementary shutter, and making the opening in the main one much longer. This, as is generally known, is the invention of Prof. Malden, another of whose inventions is the dissolving tap, which is perhaps the most effective adjunct to a lantern. These, however, were given to the public and not patented.

When using a triple not fitted with a double diaphragm, the third slide can be shown from the bottom lantern, and the shutter withdrawn before using either the top or middle lanterns.

At this stage various mistakes are liable to occur, such as forgetting to open the lens shutter, placing the curtain slide in the top lantern, or removing the diaphragm before the light in the top lantern is turned on, or forgetting to turn off the top and middle immediately the bottom lantern is on, or attempting to dissolve whilst the middle or top lanterns are still closed by means of the diaphragm.

These can only be avoided by the operator always following the same order, by keeping quite cool, and remembering what has been done and what is to be done next.

Having surmounted the preliminary difficulties and got the first picture of the lecture fairly on the screen, the operator usually has little to do except to keep the limes turned and watch the lecturer for the signal to dissolve the picture. Dissolving can be done either quickly or slowly, but it is not advisable to attempt to dissolve very quickly by the dissolver alone, as the light may suddenly drop or even go out with a pop.

The amateur lanternist generally has a breakdown of some sort in the course of a season, and for that matter so do those who cannot be classed as amateurs, but the latter are accustomed to the use of their tools and to clearly understand the nature and qualities of the various apparatus and how far liberties can be taken with them and are consequently less liable to be found out—as an example—the cylinder key may be left at home. If the spindle stands above the nut it can be easily grasped by gas or ordinary pliers, but in the case of where the spindle is below the nut, and a spanner is available the nut may be removed, the gas turned on and the nut replaced as quickly as possible.

—:o:—

A Simple Method of Coating Metals with a Dead Black.

By H. G. ROGERSON.

SEEING a communication on this subject in a recent number of the *Optical Magic Lantern Journal*, which, however, necessitated some amount of labour and care in the preparation of the material used, I have pleasure in giving our readers the very satisfactory results of some experiments I made in this direction many years ago.

The special purpose for which, at that time, I required a not only dead, but very hard black enamel, was for coating a large brass plate on which are formed by vibration the curious patterns known as "Chladni's sand figures." Those who are familiar with this beautiful little apparatus will understand the amount of friction induced by the vibrating sand, and therefore the necessity for a tough and durable coating of enamel. This "sand-plate" has

been in occasional use during the last twenty years, and is yet in excellent condition; a result which, I think, fully establishes the efficiency of the enamel for any description of work.

Nothing can exceed the simplicity of its preparation. All one has to do is to procure a little of what is known in the trade as "lamp-black ground in oil," not the costly variety used by artists, but that employed by house and decorative painters. A few pennyworth will, I suppose, last the amateur a lifetime. The dealer will probably advise the addition of a little "driers," but this would quite disqualify it for our special purpose, rendering it brittle and less adhesive.

Put this pasty mass into some convenient vessel and dilute to the required density with spirit of turpentine, in each ounce of which has been dissolved one drop of the balsam of copaiba, or a grain of Canada balsam. The liquid is now complete; but if there be the least suspicion of lumpiness, let it be strained into the wide mouth bottle in which it is to be kept, through a piece of muslin.

Allow a coating of the enamel at least twenty-four hours to dry.

—:o:—

The Lanternists Den. No. V.

By C. E. RENDLE,

NOTES ON MAKING A LAMP.

SEEING in the Notes and Queries column of the last issue of the *Optical Magic Lantern Journal*, a request from a colonial correspondent for information descriptive of making an oil lamp for the lantern, I have decided to communicate to the readers how I made what is considered an excellent lamp, and though it may not be quite a beauty to look at, it is perfect in its workings and results.

There is much to consider in thinking out an instrument of the kind. Every attention must be given to ventilation, else faulty combustion will be the trouble, accompanied by an accumulation of heat, which at once proves dangerous to lantern, condensers, and, for the matter of that, slides too.

The would-be lamp maker must provide himself with a sheet or two of good tin, sheet of thin charcoal (sometimes called Russian) iron, three feet of brass-wire size 26, metal wire gauge, a few inches of brass tubing $\frac{1}{4}$ in. inside diameter, a small sheet of perforated zinc, about 70 holes to the square inch, a small piece of flat brass, the thickness of a threepenny-piece, also pewter, solder and fluid, such as described on page 45, vol. 3 of this Journal.

Fig. 1, top of cistern.—Cut a piece of tin $3\frac{3}{4}$ inch long, by 7 inch wide. With the aid of a T square, and steel scribing point, draw a line down each side $1\frac{1}{2}$ inch from outer edge, as shown at B B B B, draw lines from point to point in corners, and cut out the triangular pieces A A A A. A piece of hard wood squared on edge must be placed against side next to line, screwed into bench vice, and bent down to right angles, same with other side, then each end in like manner.

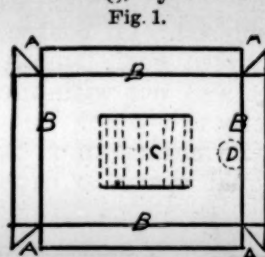


Fig. 2.

The triangular pieces at corners may now be bent flat to sides. To do this evenly, screw into vice a square piece of wood, lay over each corner in its turn, force down the overlap with the thumb, tap close with a wooden mallet, and solder soundly up. A piece of tin for the bottom about an inch larger all round, should be cut off and laid aside for the present.

Serious attention may be directed to the wick holders and wick-turners, each of which there are four, and as the cogged turners are a guide when marking the holder, they may be treated first. Twelve small wheels are required (Fig. 2). This diagram speaks for itself, so if one is first filed out as a pattern the exact size, the others may be traced from it without much trouble. To do this drill partly through a piece of flat brass to insure your centre, strike two circles with the dividers, the outer $\frac{3}{16}$ in. in diameter, the inner $\frac{1}{16}$ in. in diameter, divide these circles into five parts, and cut so that top of each tooth touches outer line, and bottom of tooth inner line. Simple as this is care should be taken in getting the wheels true, or they will not turn the wicks with that accuracy which is required for an even illumination.

Having completed the twelve wheels, we will

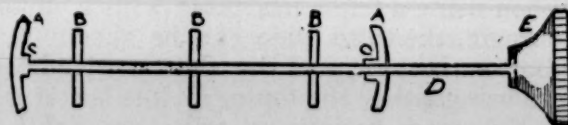


Fig. 3.

turn our attention to Fig. 3, which shows the Rod D, carrying the wheels B B B, also the back and front cylindrical part of wick holder A A, the end sockets C C, and the milled edged button E. Cut off a length of brass wire and make perfectly straight by tapping with mallet

on a flat iron. Drill and open holes of three wheels to fit tightly on to rod, place them $\frac{3}{4}$ in. apart, leaving $\frac{1}{2}$ in. of rod at the end, which we will call the pivot.

The wheels may now be fixed to rod by solder, and it may be advisable here to state, that after this and every soldering, the parts soldered should be wiped over with methylated spirits of wine, which clears away the superfluous fluid, and thereby lessening the risk when heat is brought in close proximity.

Cut out eight circular pieces of tin $\frac{5}{8}$ in. diameter, tap each lightly with a rounded faced hammer, which will slightly concave them, as A A. Next, cut eight pieces of the brass tube $\frac{1}{2}$ in. in length, keeping them flat at each end, solder one of these in centre of one of the concaved plates, first seeing that the pivot end of rod works freely in it, pass down the rod from the bottom end another of tube pieces to within $\frac{1}{8}$ in. of the wheel, and solder there. Drill a hole in another of the concaved caps that the rod may pass freely through it. It will thus be seen that though the two caps each contain a pivot hole, there is a difference in the arrangement; in the case of the front cap it is furnished and soldered to cap, but that at the back is formed by simply drilling a proper sized hole through. The object of this will be palpable as we go on.

The hole in button E should now be opened to fit on rod. It is advisable to purchase these (American clock) buttons ready for use. Almost any local clockmaker will supply the set of four for a few pence.

It must be understood that there are four wick turners required for the job, therefore, the foregoing particulars for making one applies to the other three. As they are finished they may be laid aside separately, that is to say, each with its belongings, for at present each one is in four parts.

We will now proceed to make the tubes or holders, and it is recommended to procure a



Fig. 4.

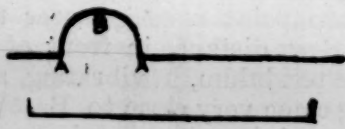


Fig. 6.

piece of 2in. wick as a guide. Cut four pieces of tin $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in., draw two lines 1in. and $2\frac{1}{8}$ in. from edge (Fig. 4) A A; bend, by aid of wood block and vice, to right angles. Screw

into the vice a piece of round iron about $\frac{3}{8}$ in. diameter, place the tin against it at B, and bend to three-quarter round, when it will take the form of Fig. 5. It is an easy matter to get these true with the fingers.

Next, cut four other pieces 3in. long by $2\frac{3}{8}$ in. Draw a line $\frac{1}{8}$ in. from each side edge, bend down to right angles as before described (see Fig. 6). This done, lay one of each together, hold between thumb and finger and try the wick as to size, which should fit easily without falling through, and these tubes must be so regulated until this has been achieved; they may then be bound together with iron binding wire and soldered down each side, and care must be taken that these holders are quite flat on one side.

It is now assumed the tubes are ready to be jumped or fixed together (see Fig. 7). Prepare two strips of tin $1\frac{1}{2}$ in. long by $\frac{1}{2}$ in. wide. The two centre tubes call for first attention, and may be tied exactly $\frac{1}{8}$ in. apart. Procure a piece of wood the right thickness, which may

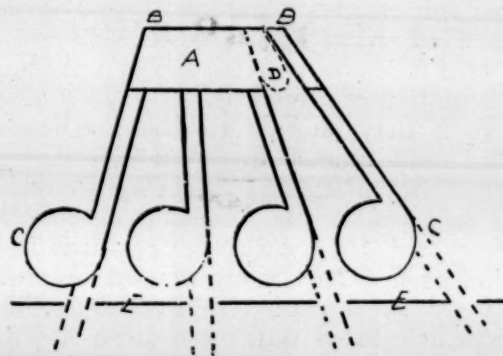


Fig. 7.

be placed between the tubes while soldering. Having fixed these to both back and front plates, the two outer ones must be placed in position and soldered at about the same angle, as shown in Fig. 7. As a further guide when the four tubes are together, the measurements should be from B to B, $1\frac{1}{2}$ in.; from C to C, $2\frac{3}{8}$ in. Now cut four strips of perforated zinc, bend U-shape (D, Fig. 7) and fix in the three divisions between the wicks. The corners of plates A must be cut and trimmed off. Looking at these holders at top, eight parallel lines strike the eye, the eight being equidistant.

(To be continued.)

—:O:—

THE essential requirements of a good lantern slide are, that in some parts of it there should be absolutely clear glass, and that the darkest shadows should be transparent.

T. HERBERT FRY.

The Royal Institution.

A LANTERN EXPERIMENT TO SHOW THE ROTATION OF THE EARTH.

IN the course of the recent series of lectures on Astronomy delivered by Sir Robert Ball at the Royal Institution, a modification by Professor Dewar of Foucault's experiment to demonstrate the rotation of the earth was performed, so that the fact could be made evident to a large auditory.

The principle of Foucault's experiment is, that if a pendulum consisting of a heavy weight at the end of a long and exceedingly slender wire be started vibrating truly in one plane, it will continue vibrating in that plane, although the point of attachment of the top of the wire be turning so as to turn the wire upon its own longitudinal axis. The point of suspension must not be allowed to describe a circle or a parabolic curve. The wire, in turning upon its own axis, will cause the weight to turn on the same axis, but will not alter the plane of vibration of the weight, consequently, so far as the plane of vibration is concerned, this motion is separated from, as it were, and is uninfluenced by the motion of the earth.

Here it may be well to describe Foucault's original experiment more in detail. Léon Foucault first made his discovery known in a paper read before the Academy of Science on February 3rd, 1851, entitled "Physical Demonstration of the Movement of Rotation of the Earth by means of the Pendulum." The experiment created much sensation in Paris at the time. A great pendulum was fitted up at the Pantheon by the authority of the President of Republic, to show the rotation of the earth, and crowds attended the demonstration daily. Foucault's earlier experiments, of course, were on a smaller scale. Of the large one at the Pantheon he has recorded that the pendulum gave one oscillation in eight seconds, so took sixteen seconds to go and return; although the oscillations diminished in amplitude somewhat rapidly, at the end of five or six hours they were still sufficiently large to permit observations of the deviation. Although the earth in turning also turned the point of attachment of the wire to the dome of the Pantheon, the weight turned with it without changing its plane of oscillation. At Paris the deviation is one degree in five minutes, the entire circle being completed by the pendulum in thirty hours; had the pendulum been suspended over one of the poles of the earth, the circuit would have been completed in twenty-four hours.

At the Pantheon the weight was of copper,

enclosing a ball of lead, and altogether amounted to twenty-eight kilogrammes; the steel wire was sixty-seven metres long, and one millimetre and four-tenths in diameter. The circle over which the ball oscillated was rather more than six metres in diameter, and divided exteriorly into 360 degrees. To make the effect of the earth's rotation more clearly visible to spectators at a distance from the circle, Foucault placed nearer to the centre of the circle than the divided scale, two circular ridges of wet sand; some of this sand was cut away at each oscillation by the metal pointer attached to the bottom of the ball. At the first oscillation a breach was cut in the sand, and each succeeding oscillation widened the breach because the two ridges were slowly turned round by the earth, whilst the plane of vibration of the pendulum remained unchanged.

As the apparent rotation of the earth is so slow, and it is not desirable that a lecture experiment should occupy more than two or three minutes, what Professor Dewar did was, by means of a small fixed point of strong light near the wire, to throw a shadow of the wire upon a distant white screen, so that as the point of light accompanying the motion of the earth moved a little way, and the pendulum was independent of the motion of the earth, the very small change of position in one minute of the point of light, was magnified on the screen to dimensions which could be quickly seen by all present.

The experiment was arranged in this manner:—A (Fig. 1) represents a horizontal disc of white cardboard, about two feet in diameter, with an arrow N S drawn upon it, and made to point truly to the North Pole. K is a



horizontal section of the electric lantern. A double convex lens—one of the elements of an old-fashioned lantern condenser—was placed at such a distance from the light that it would bring the rays to a focus a little outside E. The ordinary microscope sub-stage condenser E, however, brought them to a sharp point rather nearer the light, and a very short distance in front of itself; the wire of the pendulum, in vibrating, at one end of its swing came very close to E. When near E a shadow of the wire was thrown upon a distant screen a long way to the south, beyond S; as the wire receded from E, the shadow soon became thinner and thinner, and during the major part of the swing of the pendulum, was invisible. Thus an image was thrown of the wire, chiefly when at the most northern point of its swing. By using a single double-convex

lens only as a condenser, there was a great loss of light, but sufficient remained for the purpose of the experiment.

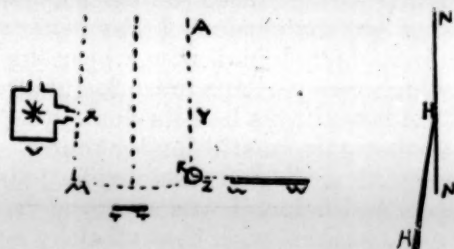


Fig. 2.

In Fig 2, A K is a pendulum, consisting of a ball of lead K, attached to a very fine steel wire A, which was perhaps forty feet long, and attached at its upper part, and in a suitable manner, to the roof of the Royal Institution. The ball of lead was about sixty-five pounds in weight, and when first started, swung truly north and south through Y and X. The electric lantern is represented at V, and the shadow, as already described, was chiefly cast when the wire was in the position X M. The circular card with the arrow upon it, mentioned in the last paragraph, is represented at T T in Fig. 2. W W is the lecturing table, and N N the screen, perhaps twenty or twenty-five feet from the lantern; H H is a long bamboo point-rod, as used by lecturers, and leaning against the screen N N. At the first starting of the pendulum the shadow of the wire is made to coincide with this rod above the point of the latter on the screen, upon the space H F, so that if the shadow of the wire should shift to the right or left, it will shift away from the pointer. Z is a fine thread, holding the ball to the lecture table in such a manner that when the thread is burnt by a flame at the point Z, the pendulum will start vibrating in one plane, exactly north and south, without any lateral vibrations. The chief difficulty of the experiment is, that the ball shall be absolutely motionless just before it is freed by the flame, and shall have no lateral vibrations communicated to it, to cause it to move in a parabola instead of in one plane.

The nature of the experiment is now clear. At the start, the lantern, the vibrating pendulum, and the pointer are all in the same north and south plane, but as the lantern is moved towards the east by the rotation of the earth, the pendulum at the same time being—so far as its plane of vibration is concerned—independently of the motion of the earth, the latter motion is indicated by the shifting of the shadow of the wire upon the screen, and that motion is so magnified under the circumstances that it becomes evident to the observers in a few seconds.

Were it possible to wait long enough, all the optical appliances might be omitted, and the cardboard with its divided circle, alone be used. As time went on, the pendulum would apparently change the direction of its swing to all points of the compass, but it is really the motion of the earth which is the cause of the appearance, and not that of the pendulum.

The earth moves from east to west, consequently the pendulum moves in the opposite direction, passing from east, through south, to west. In this optical experiment the shadow on the screen moves from west to east, but this is because the shadow is cast by light at X instead of at Y, at which latter point a light cannot be placed.

Probably some ingenious lanternist can simplify and cheapen this experiment greatly. There seems to be no reason why the pendulum at the extremity of each swing, should not be made to brush against a bent arm of a lever of little weight, and a small mirror mounted upon the moving axis of rotation of the lever, have its motion magnified by reflecting a spot of light upon the distant end of a lecture hall. This would also probably facilitate the employment of a much shorter wire for the ball than is usually found to be necessary.

The experiment herein described excited interest. We have all heard of the instrumental demonstration of the rotation of the earth, but the experiment has been witnessed by but few persons in this country.

Those lecturers who may desire to give deeper and more entertaining information as to the laws governing the motion of the pendulum of Foucault, may consult the volume for 1890 of the *Annales de la Société Scientifique de Bruxelles*, in which will be found a mathematical memoir on the subject, eighty pages in length, by the Count de Sparre, one of the professors at the Catholic Faculty of Science at Lyons. What with the inclination of the line of the horizon in London to the poles of the earth, what with the pendulum in this latitude taking more than twenty-four hours to complete an apparent complete circle, and what with other motions, Foucault's pendulum has given plenty of work to mathematicians. A better way of showing the lantern experiment than that adopted by Sir Robert Ball, would be to put the screen to the north, and the lantern to the south, so that the shadow on the screen should visually indicate the motion of the earth from west to east.

M. Lissajous, in the course of a short account of the life of Léon Foucault, says that among unpublished proceedings of the Academy of Cimento, some vague indications were found in

a phrase of Viviani, that the latter had previously made an analogous experiment with the pendulum, which had attracted no attention at the time. This, he says, aided men who were jealous of the success of Foucault. Unfortunately M. Lissajous does not quote the passage.

—:0:—

At One o'clock in the Morning

BY T. H. HOLDING, VICE-PRESIDENT LANTERN SOCIETY.

FORTY hours had not been sufficient for the carrier to get round with the hydrogen and oxygen. By dint of telegrams and special messengers of all conceivable kinds, gas bottles were borrowed, but the regulators did not fit, and then as a last resource a Pamphengos was resorted to, and we had an exhibition of approximately 250 slides in a beautiful drawing-room at Kensington. Of course there were delays. There always are over lantern exhibitions. And of course things did not go smoothly. They rarely do. So that it was after eleven o'clock before we sat down in our host's library for a brief chat and a few whiffs at a fragrant weed.

The hour of midnight struck, and soon after I took my departure, with a hand-bag in one hand containing burner and tray and a small box of slides; and in the other, regulators, piping, &c., intending to catch the last train home. The roads were slippery, and walking was slow. The frost was very keen, and travelling along the London pavement for one mile at that hour laden was no joke. The joke has to come. Of course I reached the station in time to see the red light of the train flickering out at the other end of the Glerter Road Depôt. The collector shook his head and told me that if I walked another mile or thereabouts I might catch the last 'bus. I began to feel that I wanted to see that 'bus when I started. But I trudged on merrily enough, as merrily at least as it was possible under the circumstances. When I came to that most respectable of all parts, Newer Brompton, that abuts on the Fulham Road, where piles of sky cleaving flats have covered the late nurseries, and palaces have replaced hedges, I had at last the consolation of feeling respectable myself and of being in a respectable neighbourhood. Ah! as this reflection passed through my mind, the tall figure accompanied by the muffled foot tread of a London policeman arrested my attention. His stride lengthened perceptibly. He spoke first in low and measured tones, and very respectfully. "I beg your pardon, sir." Of

course I did not know he was speaking to me. I took great care not to know it; besides, I had nothing on my conscience, and why should he be speaking to me? least of all why should a policeman beg my pardon. I was never wrongly arrested, in fact I had never been locked up even, which was perhaps more fortunately than just if the law always had its due.

He spoke again in still louder tones. "I beg your pardon, sir," and his stride lengthened still more, and before I was aware of it, he was at my side, walking with that stealthy confident air that London bobbies are noted for since the adoption of the padded slippers.

"Very late to be out, sir." "Yes, it is a little late." "Do you mind telling me where you have been?" "Not in the least." "Carrying two bags I see." "Yes, there are a couple of them." "Look pretty full." "Well, middling." "Going far?" "About a couple of miles." "Going home?" "Yes, as fast as I can get there. You will excuse my not waiting. I have to catch the last 'bus which is due in a minute." "Ah, that is not what I asked you," said the constable. "Well, what do you wish to ask me, only come along as you put your questions, as I cannot miss this 'bus." "Well, you must attend to me at any rate," said the police. "Well, what is it you want?" "You must please explain to me where you have been and where you are going." "Well, I told you I would. What is it you want to know?" "Where have you come from?" "Kensington Court." "What have you been doing there?" "Giving a magic lantern exhibition in a gentleman's drawing-room."

He walked silently by my side and did not speak for a minute till we came to the corner of the road. I looked very anxiously for the 'bus. An empty hansom passed. I made a brave effort as though to stride towards it and stop it. This was enough.

"Wait a minute, wait a minute," said the constable, "I daresay it is all right," said he. "Quite right." "Ah," said he, "I am afraid I shall have to get you to show me what you have got with you." "With pleasure," handing him my bag. "You open it." "No you open it," I said, "my other hand is engaged, and you have two."

He fumbled about a long while at the bag. At length he asked which way it was to be opened. I showed him, and it sprang open. By this time it was ten minutes to one. The streets were deserted. Not even the familiar hansom was to be seen; it had turned down a corner, and there was no 'bus in sight. But, behold, he opened that bag and saw a brass tray with a tall pin in it. A leather strap and a

little roll of red rubber piping and a small square black box. He shut it instantly, as though a very unpleasant odour had oozed from the inside, apologised most profusely for having detained me, and said "he was quite sure it was all right." He was a very smart fellow, but he should have seen what I had in that other bag. I should then not have been able perhaps to have written this to-day, because I am certain, as it was crammed full of things he had never seen the like of before, and some of them were of such a mysterious shape and were bright polished, that he would naturally suppose I had robbed a church. But I saw the 'bus and got a lift for another mile, and then finished my trudge at a quarter past one, thankful, of course, that I had a spring mattress instead of a deal board to sleep on.

MORAL TO LANTERNISTS.

Order your gas at least a week in advance.
See your lantern will work with oil as well as lime-light.

Do not be above having your oil lamp in readiness.

Do not be out after 10 p.m.

Do not carry bags through London streets.

A private carriage would be much safer.
I have several times escaped in a hansom.

—:o:—

New Apparatus.

NEW DOUBLE-VALVED CUT-OFF JET.

THE novelty of this jet, which is the invention of Mr. Beard, 62, Alscott Road, Bermondsey, is the improvement of the cut-off and regulating arrangement of the gases, which is effected in the following manner:—

In place of the usual two taps, only one tap of special construction is substituted, the shell of which has the two supply and delivery tubes to the mixing and Y chambers respectively, to either mixed or separate burners, as usual.

The plug of tap lies horizontal and has a projecting lever at right angles. In both ends of plug of taps, are fitted a screwdown valve, one for each gas—oxygen and hydrogen, with these valves the supply of gas is regulated to burner.

Having regulated the gases, they can be cut off entirely by raising the lever of plug; a small adjusting screw attached to the shell, arrests the movement of plug, and therefore any amount of by-pass can be left on.

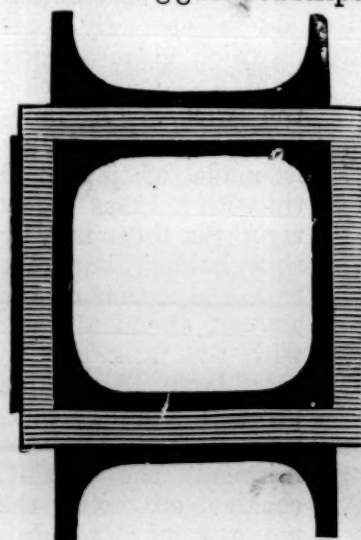
It will be seen that this arrangement takes the place of the ordinary four-way disconnector, having a decided advantage, as the whole is constructed in the jet itself and can be got at

outside the lantern, and there being no wheels or delicate parts to get out of order, or separate pieces of tubing making unnecessary joints, the gases are microscopically regulated by the fine threaded screwdown valves.

The mixing chamber is supplied with discs alternately perforated at edges and centre, thereby ensuring perfect mixing. The nozzle is large and tapered.

"SERSHALL" SLIDE BINDER.

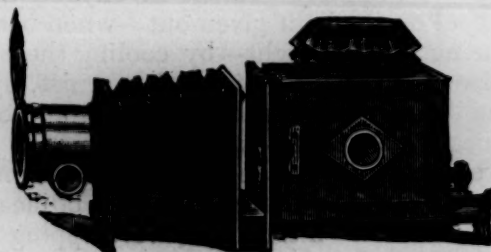
Mr. Tylar, of Birmingham, is pushing a convenient style of slide binder which should supersede the long gummed strips with which slides are



usually bound. These new binders, the shape of which is here shown, are supplied cheaply. When about to finish a slide, a binder is laid flat on a table, and the gum moistened; the transparency, mat, and cover glass, are now laid upon this and pressed well in contact. The slide is then turned over and the binder

tightly and evenly over the edge. A metallic cut-out is supplied with each box, which greatly aids in turning over the edges sharply.

The Gordon Lantern, by Mr. John Trotter, 28, Gordon Street, Glasgow, can be packed into its case without removing any part except the chimney. The jet is rigidly attached to a carriage sliding on two main tubes which form the base of the lantern, so that the nozzle of jet is immediately under the line of centre of front lens and of condenser. The carriage can be moved back and forward by a screw, so as to place the light nearer or further from the con-



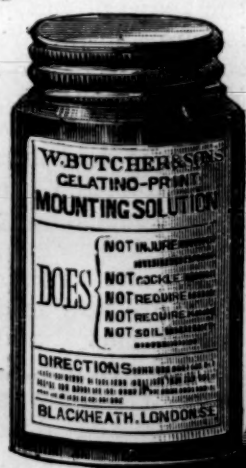
densers, but no centring is required. Provision is however made, that should the jet be violently bent it can be readily re-adjusted. The iron

body is entirely separate and can be removed from the lantern to allow free access to jet and condenser should that be required.

The lantern packs into a case $12\frac{1}{2} \times 6 \times 5$ -ins. and weighs $7\frac{1}{2}$ -lbs., complete, with front lens and condenser. The condenser is $4\frac{1}{2}$ -in. diameter. Three front lenses are supplied of the following foci, 6-in., 8-in., and 10-in.

A special case is being designed which will hold the lantern, cylinder key, limes, and regulator.

Messrs. Butler & Sons, of Blackheath, have introduced a number of new items this season, to some of which we have already called attention. Their latest novelties are a specially prepared oil for the lantern, which gives a good



light, and does not clog the wicks. A lime-holder cylinder which is made of japanned tin with a brass screw tap. Six limes may by this holder be kept from the action of the air. A chemical tank with the tank portion extra large. A gelatine print moulding solution, which neither injures the print, cockles or soils the mount, nor requires

heating. It is put up in the style shown. The firm has sent us a pretty frost lantern slide, the subject of which resembles a plume of feathers. We understand that a large number of these slides have been stocked, and that they are in great demand.

—:O:—

How to Estimate Oxygen.*

By F. P. GRUNDY AND A. HADDON.

WE need hardly point out that not only has the amount of impurity present in oxygen a very bad effect on the light given out—when used for producing the lime-light—by cooling the frame, but also on the pocket of the lanternist, by his having to use more gas than he would otherwise have to do if the oxygen were pure.

To estimate oxygen very accurately, complex apparatus such as Bunsen's, or modifications thereof, in which mercury is the trapping fluid, must be used, but for ordinary purposes Hempel's, or some such apparatus, in which water is the trapping fluid, may be employed.

* Ext. Com. L. and P. Assn.

The estimation of oxygen in a mixture may be carried out in several ways, of which the two most important are, first, by fixing the gas to be analysed with an excess of hydrogen, exploding the mixture by means of a spark from an induction coil, and measuring the decrease in volume. One-third of the contraction, due to the combination of the oxygen with the hydrogen, will be the volume of oxygen present in the original gas. Second, by bringing the gas to be tested into contact with a solution of pyrogallie acid and caustic potash, and noting the decrease in volume which occurs. The diminution in volume gives the amount of oxygen present in the original mixture, and the unabsorbed part the diluent.

We have chosen the latter method as being the most convenient and easy of manipulation, and it possesses the advantage that both pyro and caustic potash are well known to, and most probably on the shelves of all practical photographers.

The Hempel consists of two parts—the one the measuring apparatus, and the other the absorption bulbs. The former consists simply of two glass tubes about three-quarters of an inch in diameter and eighteen inches long, connected together at their lower ends by india-rubber tubing. One tube is open at the top, and the other is closed by a glass stopcock and graduated. To start an analysis, the graduated tube is filled completely with water; when connexion has been made with a supply of gas, the stopcock is opened, and as much gas as necessary is introduced; the communication is then cut off, and the level is made the same in both tubes and the volume read. The object of making the level of the water in both the same is to avoid reducing to constant pressure. The graduated tube is then connected by means of capillary tubes to the absorption apparatus, which consists of two bulbs, joined together, one terminating in a capillary U tube. The bulb nearest the graduated tube, is filled with a solution of pyro and caustic potash in water. All the capillary connecting tubes and india-rubber tubes must be filled with water in order to eliminate errors. The following is the best proportion of pyro and caustic potash for the absorbing solution:—

Pyro.....	1 ounce.
Caustic potash	24 ounces.
Water	20

The gas under analysis, after being passed into the bulb, is brought into intimate and renewed contact with the alkaline pyro by constant shaking, three to five minutes being generally sufficient. The gas is then drawn back into the burette, and again measured as

before; the decrease in volume represents the amount of oxygen in the gas. In order to make sure that no oxygen is left unabsorbed, it is again passed into the pipette, and if there is no decrease in volume on again measuring, the analysis is complete.

Another piece of apparatus for testing is of very simple construction, and could be procured at a small cost; or, if you have practised glass-blowing you could easily make it. It consists of a tube, three-quarters of an inch in diameter, eighteen to twenty inches long, and drawn out at each end. To each end is attached a short length of india-rubber tubing, provided with a pinchcock. Beyond the lower pinchcock is another piece of glass tubing, which enables the tube of large diameter to be connected to a funnel, or other containing vessel, by means of india-rubber tubing of suitable size.

In order to use it, the tube is first completely filled with water. Connexion is then made with the vessel containing the gas to be analysed. Both pinchcocks are pressed, the one to allow the gas to enter, and the other to allow the water to escape. The lower end might, with advantage, be plunged into a tumbler or beaker full of water. As soon as the tube is full of gas, both pinchcocks are allowed to close the tubes, and the supply of gas disconnected. The funnel, or other convenient vessel containing the supply of pyro solution, is now, by means of the india-rubber tubing, connected, making sure that the tubing is completely filled with liquid. The bottom pinchcock is now opened, and if the reservoir of pyro be raised, a sufficient pressure will be obtained to force some of the pyro solution into the tube containing the gas to be tested. At once absorption of oxygen will commence; and, in order to facilitate this by increasing the surface of the liquid, the tube may be tilted or shaken, the pinchcock being opened occasionally in order to prevent too great a reduction of pressure inside, and thus cause a probable leakage of air into the apparatus, but this danger can be removed if the india-rubber tubing is wired on. When the absorption is complete, place the vessel of pyro, with the pinchcock open, so that the level of the liquid is the same in both tube and reservoir.

The tube must either have been graduated before, or, if only a few measurements are to be made, and the operator does not care to go to that trouble, the volume of the tube can be ascertained by completely filling it and measuring the contents in an ordinary graduated measure, then turn the tube upside down and fill with water up to the mark occupied by the unabsorbed gas.

The percentage of diluent can be easily

obtained by dividing the volume of the residue in drachms or cubic centimetres by the original volume and multiplying by 100. Thus, suppose the volume of the unabsorbed gas to be 17 drachms, or c.c., and the volume of gas operated on 80 drachms, or c.c., then the percentage of diluent will be $\frac{17}{80} \times 100 = 21.25$.

There are one or two precautions to be observed in using pyro and potash. First, it is no use to try and absorb oxygen with a weak solution of pyro; it must be about the strength given above. Secondly, it must not be used too often, or left exposed to the atmosphere, as after a time it begins to give off carbon monoxide, which would seriously vitiate the result of the analysis.

The results of the analyses of various samples of oxygen, which we have obtained during the last fortnight, are as follows:—

	N%	O%	
No. 1. ..	15.5	84.5	Same maker at different times.
No. 2. ..	39.4	60.6	
No. 3. ..	43.1	56.9	
No. 4. ..	43.8	56.2	
No. 5. ..	25.4	74.6	
No. 6. ..	7.0	93.0	Another maker.
No. 7. ..	3.8	96.2	Made from chlorate and M_2O_2 at R.N.C. for lime-light.

In conclusion, we hope that every one who uses a lime-light, for whatever purpose it may be, will, if he wishes the light to be at its best and constant, take the small amount of trouble that is necessary in order to master the few details, so as to enable him to test the gas sent in, and, if it should contain more than a certain percentage of diluent, either return the gas as unsatisfactory or demand a reduction in the price, as, under these circumstances, not only is the article supplied bad, but apt to cause the user to acquire a bad reputation, which is of far greater importance than the cost of the gas.

We trust that the time will soon come when makers will guarantee that the percentage of purity is between certain limits, and then, if it is not, a remedy can be easily obtained. To issue as oxygen a mixture of air and oxygen, so that it contains thirty or forty per cent. of an inert and flame-cooling gas, is no better than the act of a publican who adds water to his beer and dilutes his whisky below what is allowed by Act of Parliament, and sells them as unadulterated.

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I CONSIDER a hand camera an indispensable part of the outfit of an explorer. I am led to this conclusion through my recent journey to North Greenland, as a member of the Peary Relief Expedition. W. E. MEEHAM.

How to Get, Please, and Retain an Audience. No. II.

HOW TO PLEASE AN AUDIENCE.

BY E. BAKER (SALISBURY).

BUT for the various appreciative references from correspondents since the publication of the first portion of this article, I should have regarded it as insufficiently covering the ground; but it was intended, as, indeed, subsequent notes will be, as "suggestive," rather than exhaustive. In perusing a few further suggestions tending in a similar direction, many hints may be afforded which are by no means new or original, though they may be helpful to some amateur lanternist who is comparatively a novice in regard to the measures by which success can be most surely achieved.

Experience has shown conclusively that the period has arrived when as a means of amusement merely, the lantern is capable in competent hands of affording not merely the materials for furnishing immoderate laughter, but of combining elements calculated to please and edify as well as merely to amuse.

There is now less excuse than ever for exhibiting subjects in which the comic element is the supreme and only purpose. Those (if there are any still remaining) whose highest conception of the lantern in its various forms is the representation of the ridiculous element to the exclusion of at least a fair proportion of more solid matter must not blame themselves if the term "magic" lantern, which somehow or other clings so tenaciously to this charming and useful instrument, is synonymous with which the grotesque is expected and anticipated as the prominent element. That average audiences are really and permanently pleased with this class of exhibition is, as far as personal observation is concerned, and increasing so, a conspicuous fallacy.

Passing from the negative to the positive aspect in pleasing an audience, it may not be amiss to point out that the plentiful supply of really first-class subjects, which is receiving constant additions, leaves no excuse for presenting second rate productions.

The genius of the poet and the dramatist is now skilfully represented by the photographer and the slide artist, thus rendering it possible to present upon the screen pictures which are as artistic in their conception as they are instructive in their tone and sentiment.

The beautiful and touching strains of Tennyson's ennobling verse in some of his best known poems, such as "Dora," "The Brook," &c., have been thoughtfully wrought into Nature's

scenes of the most picturesque character by some of our best slide photographers whose life model productions indicate the most carefully conceived interpretation of the works of both poets and prose writers. Longfellow's "Village Blacksmith" is a similar example of an excellent set.

Nor has there been a more useful accession to the slide producers library of desirable subjects than the poems now somewhat numerous of Mr. G. R. Sim's, in which the various qualities of pathos and sentiment, with an occasional element of the more tragic character, are peculiarly adapted for scenic representation. "The Lifeboat," "The Signal Box," "The Road to Heaven," "Billy's Rose," "The Magic Wand," are types of a class of story which are familiar with most lanternists, and may be found in the stock catalogue of various opticians. The religious and temperance movements of the day have also received increasing attention from the increasing army of slide producers, for besides representations of all the best known painters and engravers who have become famous for sacred heart, the constantly increasing productions of the press which encourage literature of the highest moral and temperance teaching, have been in many instances re-produced in such a way as to deepen the impressions made upon the minds of those who have read such works as "Peep behind the Scenes," "Her Benny," "For Mother's Sake," "Bells across the Snow," with many other equally popular stories published by the Religious Tract Society and the numerous private commercial houses, amongst which are Horner's, whose stories are published by tens of thousands. Thus abundant scope is afforded for furnishing every class of audience with an entertainment which shall be at once instructive and pleasing while rendered on the screen, as well as calculated to leave an impression for good on the minds of the audience.

If we seek to raise the standard of these exhibitions, whether for a large public audience of adults, for a Sunday-school, Band of Hope gathering, or a promiscuous assemblage of all ages and classes, the end will be most fully attained by aiming at high-class subjects, and the best possible results in the way of presenting and illuminating the pictures. This suggests another element in the direction of pleasing an audience, viz.—avoid creating a false impression with regard to the character of your entertainment. "Announce nothing that you are not fully competent to perform." I could cite instances not a few with personal observation in which defiance of this precaution has led to results which could only be expected,

and which were richly deserved. A business transaction brought the writer into contact with a party who possessed at least one characteristic which, confined within reasonable limits, serves a useful purpose, viz.—the faculty of self-esteem, an ingredient not altogether to be deprecated in public life, although, if left unchecked, it often leads to most ludicrous results. In this instance, a varied programme of pictures and music with some less desirable supplementary items was introduced to the public under the flaming introductory announcement that the “Unrivalled Dramatic and Operatic Entertainment had enjoyed the patronage of most of the crowned heads of Europe, besides every known Asiatic and African prince.” Probably it will be thought by most readers (considering it was the first occasion the thing had ever been floated) as tolerably “tall talk.” Of course it is taken for granted that the public do not accept such exaggerated balderdash, yet apart from any moral consideration attached to the promulgation of such falsehood, the public after all is not so easily gulled, and an entertainer seeking popularity by such measures richly deserves the short lived fate which this venture experienced.

An equally amusing incident illustrating the same aspect of the question occurred very recently, when a curious desire to “compare notes,” led the writer on a pleasant evening to visit a town where a series of recitals were to be given, to be illustrated by a firm which shall of course be nameless. As the promoters evidently intended that the pictorial part of the evening should be an attractive feature of the proceedings, the particular paragraph in the bill announcing the proceedings was not the least conspicuous portion of the printer's art, and would ordinarily form a good advertisement for the party responsible for the dramatic display. The only advantage derived in taking a long journey to the scene of operations, and possibly “learning a wrinkle,” was to discover very distinctly how NOT to do it. The display would have been only tolerable from a raw amateur; but as the acknowledged production of an accredited operator representing a reputable house, could only be characterised very mildly as being “as a failure, a great success”; or, put another way, “as a success, a great failure.”

Unfortunately the press awarded very faint praise, if any, and as the public oracles often err on the side of charity rather than severity, it may be assumed that the public were not highly gratified. Only those who have time and skill with suitable apparatus should attempt elaborate “effects,” or the almost certain consequence will be to exhibit what one

frequently “detects” a group of angels designed to appear in the ethereal space of a blue sky, but really appearing behind those who are supposed to be gazing on them in the branches of a tree instead of in the correct position, suggesting certain entanglement of the flowing robes with the foliage of the trees into which they have by mistake descended, is at once too absurd and damaging to be risked by any exhibitor who desires to please the public. Only those can fully appreciate the value of these observations who have witnessed the splendid entertainments of Mr. B. J. Malden, whose production of these charming results which add so much to the popularity of his lectures have never been surpassed, and as far as personal experience goes, remain unequalled. These, however, are the fruits of prolonged experience, continual and adequate practise, and skilful manipulation allied with apparatus specially designed for the most elaborate effects. Such results are only possible to those who are prepared to devote means, study, and unlimited practice to the attainment of even moderate success.

Painstaking operators need not be discouraged however, for the presentment of a well-lighted skilfully registered picture will always command a suitable reception; the numerous minor details of a really well managed and pleasing exhibition must be left for consideration in the remaining fragment, “How to retain an audience.”

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The Lantern of the Future. No. III.

By W. H. HARRISON.

At the conclusion of the second article of this series, published in these pages last month, a general summary was given of the points which seem to be desirable in a good ordinary lantern of the future, without any great increase in present cost, because the extra expense of a good triple condenser of colourless glass will be partly balanced by the use of a single achromatic projection lens of not less than nine inches focal length, in place of the portrait combination or modification thereof now in use.

It is highly gratifying to see that Mr. Thomas Fletcher is giving attention to lantern subjects, as evidenced by an article in these pages last month, for I assume him to be “the” Mr. Thomas Fletcher, and not “a” Mr. Thomas Fletcher, this means that something good may be forthcoming before long, in the matter of three-ring gas and oil burners for lanterns. At present, the wants of a section of the public

seem to be unsupplied in the matter of lanterns; that is to say, there are some willing enough to buy such instruments, but who do not care to have compressed gases in home use, or to employ gas-bags, or have the occasional trouble of making oxygen. Such persons would rather wait before purchasing a lantern, until the illumination of oil and of coal-gas lanterns is improved by a better optical system and by better lamps. Before long, competition is sure to bring about these improvements in oil lanterns, and already, not a hundred miles from the office of this journal, a celebrated maker of good optical instruments is displaying in his window lanterns, which are labelled to give the best possible illumination with the oil light. The construction of these particular instruments I have not examined.

To return to Mr. Thomas Fletcher, he was quite right in saying that my previous utterances were devoted to the problem of getting the best rendering of lantern slides upon the screen, without reference to other uses to which the lantern might be applied, but at the same time think that his article is founded upon a mistake in the matter of optics, and that the triplet condenser instead of being worse for the purpose he mentions, is better than the doublet. His objection is:—"If the double plano-convex condenser is used, the front of the apparatus can be made to swing back, the front half of the condenser removed and put in the vertical arrangement, without the necessity for shifting the lime dangerously near the condenser, dispensing also with an extra condenser and the consequent loss of light. . . . With a divided condenser, two mirrors, and a box, a first-rate vertical arrangement can be made, costing very few shillings."

Why cannot the same be done—and better done—with a triple condenser? The function of the first two lenses is to collect a wide angle of light from the radiant, and convert it into a parallel beam. This done, the distance of the third lens of the triplet from the other two may be great, and mirrors used as stated by Mr. Fletcher. The function of the third lens of the triplet is to cone down the previously parallel beam of rays, and send the whole of the light through the projection lens. With an ordinary doublet, the rays from the radiant are not rendered parallel by the lens nearest to it, unless the distance between the two is such as to cause great loss of light. If the radiant be brought nearer, the loss of light occurs on the other side of the lens, for the whole of the diverging beam then cannot enter the next lens of the doublet, and the further that lens is removed from the first one, the greater is the

amount of light lost. Therefore the triplet has an advantage over the doublet in this matter, so much so, that Zeiss, in some of his optical apparatus, does not trouble how far off on the base-board he places the projection part; the first two lenses of the triplet having given a parallel beam, so practically it does not matter whether the third lens of the triplet be placed close to, or two feet away from, the other two. By means of tubes in the form of velveted sleeves, he shifts the front element of the condenser backwards and forwards to any extent convenient for the particular purpose. The triple condenser is thus better than the double condenser for the purpose mentioned by Mr. Fletcher, and perhaps for all other lantern projection purposes. It is true that a parallel beam can be obtained with a plano-convex lens and with the radiant pretty close to it, but then the lens must be a very thick bull's-eye as in some of the lanterns of the past generation, and one to be deprecated because of its extra liability to fracture by heat, and because of the objectionable amount of spherical aberration it produces.

A man who can take a pocket-handkerchief, not chemically prepared, from any person in a public meeting, and can put it in the centre of a vast flame in which it is not consumed, is a person to be respected. Such a man is Mr. Fletcher, who lives in the midst of flames and furnaces, not because of a screw-loose in his theology, but for the benefit of the human race, so it is to be hoped that he is devising something good in the matter of burners for lanterns, and in those parts of lanterns greatly exposed to heat. Here it may be mentioned that the present cry by some operators for smaller lanterns, may be all very well in the case of their usage with the lime-light, but does not apply to oil lanterns, which are all the better for being roomy, and must have large air passages. A man may wish to try different lamps and burners in his lantern, and would be hampered in experimenting in this direction did the lantern have a very small body, adapted to one lamp alone.

The base-board of the lantern of the future should be a long one, to form, in front of the condenser, a table on which apparatus can be placed in projection experiments relating to physics, chemistry, and other sciences. To have any optical part of the arrangement upon one platform, and the experimental part upon another, would be a more shaky and troublesome arrangement than the placing of the whole upon one platform, so that any vibrations should be taken up by the whole system in common.

Philadelphia was the place which early recog-

nised the probable value of the lantern for educational purposes in these modern times, and some of the arrangements at present in use, had their origin in that city some twenty or thirty years ago. Dr. Morton and Mr. L. Marcey gave much attention to the improvement of the lantern in those times. The two-wick paraffin lamp, with the end edges of the wick towards the condenser, was, according to Mr. Lewis Wright, the first advance in petroleum illumination for the lantern, and was soon introduced into England by Mr. Woodbury; this two-wick lamp was equal to sixty or seventy candles. The present popular three-wick lamp is on the same plan, and gives a light of eighty to ninety candles. Mr. Marcey was against its introduction, stating it to be inferior to a lamp with a double wick.

In the present average oil lantern, the greatest loss of light is in the condenser. Frequently much light is lost because the rays projected by the condenser cannot get through the projection combination, by reason of the small diameter of the latter, or the too great length of the tubular mount; the employment of a single achromatic projection lens will facilitate getting rid of any length of mount difficulty. In a lantern with a tin cone firmly fixed to its front and carrying the projection combination, the construction is sometimes such that it is not easy to find out how much light, if any, cannot get into the projection lens, but is lost against the sides of the cone. A good plan in such case, is to take the lamp and condenser out of the lantern, supposing the cone not to be removable from its front, and to mount them and the projections lens upon a table, at the relative distances apart at which they have been found to work best. Then if the end of the cone of rays cannot get into the projection lens, a piece of white paper placed against the back of the lens to collect them, will give an idea of how much light is lost.

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Mr. W. I. Chadwick on Lantern Experiments.

BEFORE the South Manchester Photographic Society, on December 26th, Mr. Chadwick read a paper and gave a demonstration of the capabilities of the optical lantern. Of the thousands of lanterns possessed by amateurs for private and home use, few were ever used for any other purpose than showing slides on a screen. "We may entertain our friends at home with a miscellaneous collection of slides—holiday reminiscences, or wanderings in a foreign land—and when our store of slides has been exhausted

there are scores of thousands of others to be obtained by purchase or hire. Indeed, so many are there, of all places and all subjects, that it is not surprising to hear of people becoming confused with the variety when looking through some traders' catalogues, and in not a few cases people had been known to become quite demoralised in their selection, and to finally decide upon, say, five or six dozen comic slides.

A RAGGED-SCHOOL ENTERTAINMENT.

"Not very long ago the superintendent of a ragged-school called upon me, and I promised to give a lantern entertainment at his school. We had some talk about the class of audience and the nature of the entertainment. 'Bring plenty of comic slides, something to laugh at,' said he. But I had my own idea about that, and persuaded him to leave the selection to me. When the time arrived I found that my audience consisted of about 300 to 400 boys and girls, from twelve to twenty years of age. I told the superintendent and some of his committee who were present that I intended to test the taste of the boys and girls, and to educate them if possible, to a higher standard, and I started with half an hour at the seaside, a popular scientific lecture.

" 'HALF AN HOUR AT THE SEASIDE.' "

"The slides were very pretty pictures, and I talked to them about the seashore, the clouds, and the sky, the salt water and the seaweeds, the pebbles and the shells, cockles, mussels, the crab and shrimp, and so on; and then we went to sea in a fishing smack, and after landing our fish, we saw it being sold by auction at Grimsby Docks, then packed in boxes, and finally we found ourselves at the Manchester Wholesale Fish Market. I then told my audience that the next few pictures would speak for themselves. They were of two distinct kinds, and would be shown two of each kind together alternately. The first two were most beautiful photographs of snow and frost, the second two comic pictures, followed by two statuary slides, and then came two more comics, some things to laugh at, but nobody did laugh. I further explained that they could have plenty of either kind, and it was for them to say which they liked best, the pretty pictures or the comic. They decided by an overwhelming and almost deafening majority in favour of the pretty pictures and 'more seaside.'

" 'MORE SEASIDE.' "

"Then I gave 'Dick's Dive in a Duck-pond' and concluded the exhibition with a few photographs of trotting horses and other animals in motion, shown by a wheel of life adapted to the lantern, and I have every reason to remember

that audience as a most appreciative one. When all was over I asked the Superintendent what he thought. Here, I said, I have given two short scientific lectures, shown over eighty scientific slides, and only six comic slides, which latter were not appreciated. Now this is a lesson that might be carried away in hundreds of cases. Science need not be dry, nor uninteresting, nor difficult so to understand. On the contrary it could, by aid of the lantern, be made a source of endless entertainment and instruction, and the lantern when properly constructed, lends itself to almost every branch of science. By its experiments and demonstrations to our friends at home may be conducted with far less expenditure in apparatus and material than by any other method. It would be out of the scope of the present communication to enumerate the home experiments that may be performed even with an oil-burning lantern and a few accessories that are easily made or purchased for a few shillings.

"BOOKS ON OPTICAL PROJECTION.

"But, How to begin? Well, there are plenty of books published on the subject of optical projection, and a new one, just published, *Sunshine*, by Amy Johnson, L.L.A., F.R.A.S., is a delightful lantern book, comprising a series of about forty popular experimental lectures on science delivered to young people, with special considerations for optical projections. Indeed, there is a section of the book devoted to lantern projection, with practical hints and home experiments. Another charming little book is *Soap Bubbles and the Forces which Mould them*, by Professor C. V. Boys, F.R.S. This book also contains a section of practical hints to the lanternist for making and projecting those interesting and fascinating playthings of our boyhood, soap bubbles. The author also describes other experiments, 'so wonderful and yet so simple that, if they had been performed a few hundred years ago, the rash person who showed them might have run a serious risk of being burnt alive.' Lastly, *Science at Home*, a pamphlet by the late W. B. Woodbury, is recommended as containing a number of beautiful lantern experiments, all of which may be easily performed in our own family circles by the merest tyro.

"THE LANTERN ITSELF.

"Respecting the lantern itself, much might be said in favour of lime-light, though for home use a good oil lamp—one that does not smell or burn like a roaring furnace—is very convenient, and answers most purposes if the screen be not too large. A good opaque screen, about four feet six inches square, was generally large enough for home use with an oil lamp; but in a large

room—still using the oil lamp—a translucent screen of about the same size would be better; and it might be worth while to mention that only a few days ago a most successful exhibition was given to an audience of over 200 people on such a screen—three feet six inches square—with an oil lamp, and it will be seen that had the pictures been projected to seven feet by the same luminant, the illumination would only have been one-fourth, because seven feet square is four times the area of three feet six inches. By using compressed oxygen in cylinders, as now supplied commercially, there is practically no danger in using the limelight, and it may truly be said to be safe, or safer, than a paraffin lamp."

VARIOUS EXPERIMENTS.

Mr. Chadwick then proceeded to exhibit a number of experiments. A wire stand was made to support a thin metal plate in a horizontal position (edgewise to the condenser), and under it was placed a spirit lamp. In a few seconds the plate became quite hot, and then a single drop of water was allowed to fall on upon the hot plate. The drop of water at once assumed the spheroidal form, and on the screen it could be seen separated from the plate by a film of vapour. The spirit lamp was now removed, and as the plate cooled the drop of water burst into steam and was gone. This beautiful experiment illustrated a frequent cause of steam boiler explosions. From suddenly letting off steam the water in the boiler assumes the spheroidal form, and a thin film separates the water from the boiler, which later rapidly heats. The engine-driver or the fireman, thinking his water is getting low, pumps in cold water. He thus cools the boiler, destroys the spheroidal form, and the accumulated heat, suddenly converted into steam, bursts the boiler. A long focus lens is best for showing this experiment. The same experiment is often seen in the kitchen, when cold water is put into a hot frying-pan, and the water runs about in "blobs." This was followed by experiments illustrating the retention of images on the retina by pieces of perforated card placed in the lantern. White spots were seen on a dark screen. After a minute the light from the lantern was shut off, and the screen dimly lighted from a gas bracket in the room. The audience saw the spots now reversed and quite black on a white screen. When a photographic negative of a portrait was projected on the white screen and looked at for a minute, the portrait was not always recognisable, but directly the light was shut off the image was "seen" as a positive and at once recognised, as some one said, "You see it when you don't see it, and then you do." A number of experiments

in colour were next performed, producing the complementaries, followed by some most interesting optical, chemical cohesion, and adhesion experiments. By what is known as the vertical attachment applied to a lantern other experiments were produced, including the motion of camphor upon the surface of water. A number of thin shavings of camphor were delivered to the water surface and projected on the screen, when they were seen, much magnified, rotating and twirling about in manner extremely interesting, but not "unaccountable," for the motions of camphor are now well understood by scientists. It was also shown that camphor was not the only substance that produced similar motions under similar conditions. A chameleon was made to show changes of colour; primary colors produced white light; and, by a wheel of life adapted to the lantern, the motions of trotting horses, birds on the wing, and other animals in motion were shown upon the screen.

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Making and Finishing Lantern Slides.

By J. MENCARINI.*

LANTEEN shows, or as commonly called "magic lantern exhibitions," have become so very popular, that I thought a demonstration of how these entertainments were made would be interesting to you. I have therefore come forward not as an inventor of some "Mencarini patent," but simply as a narrator of what I have learnt myself of this fascinating pastime, from books, periodicals, and a little experience.

We all remember our younger days, when to be taken by our parents to a "magic lantern show" was as great a treat as to be given a piece of "butter scotch." How many times have we gazed delighted on those large pictures shown us on a white sheet, and wondered how they were done, and what a respectful admiration we had for that man who could show us such wonderful things! Well, now, anyone with but little work can produce those "magic pictures."

Great are the advantages of "lantern shows"; it delights and instructs the juveniles more than at first thought would seem. And so much am I convinced that it does instruct, that if I should have it in my power I should make it compulsory for every schoolmaster to have a magic lantern, and give at least once a week an exhibition showing some of the superior slides which can be purchased on any

subject required at a very small cost. By further explaining the subjects, geography, natural history, astronomy, etc., could be taught and be impressed more on young minds than by hours of pondering over books, which in many cases are not understood, and which are repeated as by parrots.

Very much has certainly been done in this line—scientists and public speakers have been convinced of the enormous advantages there are in using the lantern to illustrate their papers. What would require a long explanation, and then would not convey to the mind a perfect idea of the subject, with the aid of a magic lantern and a photographic lantern slide, can be shown to a large audience one hundred times larger than nature and with all its details.

Photography has been rendered so very simple that I cannot understand how every man or woman having a spare moment does not make his own pictures. How many are the occasions when, if you had been able to take a photograph, you would have pictures of places dear to you, and which are bound to bring agreeable recollections in days to come.

For a comparatively small sum you can purchase an outfit, and surely you can always find a kind friend who could explain the mysteries of this most entertaining and useful of pastimes; and I can assure you, that although it is many years since I dedicated my spare moments to photography, still I find there is such a fascination when watching the exposed plate being developed, especially if the negative has been correctly exposed, and the development proceeds gradually and the result is a good, brilliant negative, I know not how to express the intense satisfaction it produces.

But I observe I have deviated considerably from the object of my theme. I shall now come to the point.

Of course the principal thing you must have for slide-making is a good negative; this can be of any size desired, but should be, to give good result, clear, crisp, and full of details.

There are two ways to produce lantern slides—one is by contact, that is the film side of your negative and the film side of the lantern plate are placed back to back in a printing frame, and exposed either to day or lamp light. Usually for this kind of work the negatives are on quarter-plates, but I have seen lantern slides made from other sized plates when only part of the negative was required.

The other way is the most used, and this is by reduction with a copying camera. Better results are given in this form.

Most complicated and expensive apparatus

* Foochow Camera Club.

are catalogued by home manufacturers, but as you may see to-night, my only appliance is simplicity itself. A board 4 feet long by 12 inches wide; to this is screwed on perpendicularly another board 18 inches high, which has an aperture large enough to hold a negative. Opposite this I place the same camera I usually take my photographs with; this is an "Optimus" full-plate, long focus instrument, to which I attach a Voigtlander rapid wide-angle euryscope, using a required size carrier in my dark slide.

Having determined on the focusing screen the proper distance between the negative and the lens, I firmly screw the camera on the board, marking the place, and so am saved the trouble of re-adjusting the camera every time it is required.

I prefer doing my slides in the evening when I am at leisure. The plates I use are Ilford Special Lantern Plates. I find these and the same manufacturer's white-labelled dry plates the best suited for our climate. Wet collodion lantern plates are preferred by some, and certainly they possess their charms; but dry plates have the advantage to be ready prepared, economising much time, and are so cheap—one shilling a box of a dozen plates—that I do not think it worth while messing about, as in old days, with collodion, silver baths, etc.

The exposure varies, of course, according to the density of the negative, the light, etc., but the average exposure is about two minutes by lamp light.

To develop, any of the recognised formulæ can be used, my advice being to use the developer specially recommended on the box by the maker.

After developing and washing, a few minutes in an alum solution hardens the film and clears somewhat the high lights. Do not make the hypo bath too strong, and wash finally for about half an hour.

The slides can be finished by toning with either gold, platinum, or uranium nitrate, but this is not necessary if the exposure and development are correct. Clouds are printed in whilst exposure is carried on, but are very difficult to work. When the plate is dry it is mounted with a cover-glass, placing a lantern mask between the two glasses, and binding them together with specially prepared lantern-slide binding strips.

The magic lantern, or as it is more pompously called "the optical lantern," can be lighted either with kerosine oil, oxy-hydrogen lime-light, or by the new Aero carbon incandescent lamp. The picture is better shown on a white

wall, but fairly good results can be shown through a thin shirting screen.

I will conclude by advising you to try photography and lantern slide-making, and you will, I have no doubt, experience the same enthusiasm as I have for this entertaining and useful occupation.

—:O:—

"PRACTICAL PHOTOGRAPHER."—We have received from Messrs. Percy Lund & Co., a handsomely bound copy of the "Practical Photographer for 1892." In perusing this volume one cannot help noticing what a vast amount of valuable information has been collated by its able editor, Mr. H. Snowdon Ward.

LANTERNISTS will be pleased to hear that a recent discovery made by Mr. F. Iles, of Birmingham, bids fair to place in their hands a number of new colours and tones which are eminently suitable for lantern slides. At a meeting of the Midland Camera Club, Birmingham, the president (Dr. Hall-Edwards) exhibited a number of prints and slides toned by the "Photochrome" Process (Patent). The tones obtained were very numerous, varying from a grey-blue to a bright blue, and from blue-green to a bright emerald green. A large number of bromide prints toned in a great variety of colours were shown, some of them were exceedingly artistic. A very much larger range of tones was shown in the slides than in the prints, this, Dr. Hall-Edwards explained was due to the fact that the experiments upon papers had only just been commenced; whereas, nearly every make of lantern-plate had been dealt with. Messrs. Iles and Edwards are still working and experimenting, and hope shortly to bring their results before the public. The colours are said to be permanent, or at any rate, as permanent as the image upon which they are produced.

—:O:—

Correspondence.

SLIDES TO LOAN BY THE BRECHIN PHOTOGRAPHIC ASSOCIATION.

[To the Editor.]

DEAR SIR,—Our slides illustrative of "Linen and its production" with notes on slides, may be borrowed by those interested, on payment of a fee of 6d., to cover postages, &c. Borrower of course to pay carriage both ways. The slides are in charge of our curator Mr. J. C. Middleton, 12, Market Street, Brechin, N.B., to whom application ought to be made—I am, Yours very truly,
JAMES D. ROSS, Hon. sec.

SCREEN AT AN ANGLE TO LANTERN.

[To the Editor.]

DEAR SIR.—Being a constant reader of your Journal, and having received many useful hints from notes and queries. I noticed the questions by G. Orpwood in your last issue, and as my experience with opaque screens may perhaps help many others, I venture to send it.

About two years ago the Wesleyan Band of Hope committee decided to purchase a lantern outfit and a 12 foot screen. By somebody's error we received a 12 foot

opaque screen with batten and roller. Our room is long (70 feet) and narrow (26 feet), but the width is reduced by a projecting wall in the centre to about 13 feet. This compelled us to show from the side, with the result that at 24 feet distance, and a $6\frac{1}{2}$ inch focus, with oil lamp, our picture if square, was nearly a foot deeper on the side farthest from the lantern. We soon found out the cause and tried to get a stand, but no maker mentioned such a thing; fortunately one of our committee (an old lanternists), came to our help and made a stand, which has answered well. It is very easily put up in less than five minutes. We have been told by many persons including lanternists, that it is the best screen and stand they have seen. The same person also planned out a box to hold lantern, oil can, reading lamp, slides, tools, and in fact everything we are likely to require with an oil lantern, including a stand 5 feet high, which will carry two lanterns and is perfectly rigid; it has also a central shelf where the operator puts his slides and a small lamp. My own experience is that with an oil lamp the opaque screen increases the brilliancy of the picture at least 20 per cent, and for local work with a good stand, should prove a great advantage to many who are now bothered with the creasy ordinary screens. I have not sent details as I have no opportunity just now of consulting the inventor. Thinking, however, that the idea as to what could be done, might be some small public benefit I venture to send them, and at the same time thank you for the many useful suggestions I have received from your capital paper.—I am, Dear Sir, Yours truly,

T. ANNS.

FILM LANTERN SLIDES.

[To the Editor.]

SIR,—Now that cut films have been brought to such perfection both in transparency and quality, I am greatly surprised that some enterprising manufacturer does not place lantern films on the market, there seems to be no reason why this could not be done at the same price as glass plates (1/- a doz.), and there could be little doubt that such films would in a short time take the place of glass altogether, and command an enormous sale. If coated with a chloride of silver emulsion, the printing could be done in an ordinary printing frame, and the progress be examined from time to time as easily as paper.

Then as regards mounting, if the film side were protected with a piece of talc or thin transparent eilluloid, and placed on a mask of thin sheet metal, the edges of which could be turned over the films and so bind them together, it would form a most compact and unbreakable slide. Such slide would have also the advantage (as 50 of them would only occupy a space of about 3 inches) of being sent in a cardboard box by parcel post, for about 3d; this convenience for persons living at a distance would be a great boon.

For amateurs who make their own slides, the metal masks could, if cut out of thin sheet Russian iron with a die, be supplied with profit at 2 or 3 pence a dozen, the edges could be turned over sufficiently to allow the films to be slid in from the side, it would then only be necessary to place the side in an ordinary letter press and give it a squeeze to complete the binding.

The advantages of such slides from their lightness and freedom from breakage to all those who store large quantities will be at once apparent, and I have little doubt a large profit would accrue to any introducers of them at popular prices, such as I have suggested.—Yours, &c.,

L. S. D.

WARM SATURATORS.

[To the Editor.]

DEAR SIR,—In November, 1890, I brought a saturator or ether vapourizer, and have used it ever since. I must say, owing to reading so many alarming accounts through the use of these articles, I have often quaked very much. I think every exhibition I have given this season, I have hissing, pops, and some very loud reports.

Once when using my lime boxes for tableaux, I had to ask the audience to give me $\frac{1}{2}$ hour to myself; (as it was a private house this was soon done, and the room cleared,) I really thought I was going to have an explosion. The fault I found was I had put far too much ether into the vapourizer, upon emptying out nearly a pint, the whole thing went quite smooth, except the hissing.

This season I thought I would try warming the vapourizer, and had a tin can made about 18 inches long and 3 inches diameter, this I fill with very hot water (before leaving house), place it between the two tubes of saturator, the whole being in a box and packed with wadding. I can assure you it is quite a comfort to use the lantern now, the light comes at once, and the dissolver acts beautifully.—Yours,

C. DALES.

P.S.—The tube from the saturator should be held up in some way so that the condensed vapour cannot run back to vapourizer, or a jerky light will be the result, should the exhibition be of any length, and the room cold.

A REPLY TO Mr. THOS. FLETCHER, ON
CONDENSERS AND EXPERIMENTS WITH THE
LANTERN.

To the Editor.

SIR,—In writing in your January number, Mr. Fletcher calls attention to some remarks of Mr. W. H. Harrison in the December number, in which the latter gentleman recommended a triple condenser, but Mr. Fletcher says that "Mr. Harrison evidently forgets that this form of condenser although useful for common slide showing, is very objectionable when the lantern is used for physical demonstrations," and continuing, Mr. Fletcher states, "if the double plano convex condenser be used, the front of the apparatus can be made to swing back, and the front half of the condenser removed and put into the vertical arrangement, without the necessity of shifting the lime dangerously near the condenser, dispensing also with an extra condenser and consequent loss of light."

Well, one does read funny things sometimes, but I don't remember reading anything so amusing, since one of your contributors a few months ago stated that the double condenser supplied by the firm with whom he is commercially engaged, and called their "universal" condenser was equally suitable for all objectives of from 4 to 12 inch focus. Of course in the latter case it was simply an advertisement, got in the wrong column by disguise, but in the case of Mr. Fletcher making such a misleading statement, and his endeavours to set Mr. Harrison right, there can be only one conclusion. I would therefore refer him to my paper on lantern condensers, recently published in these columns, or I shall be pleased to send him a copy of it. And now I ask the right in self defence, for stating, even in these columns, that I manufacture a triple condenser far more suitable for physical demonstrations, than any double condenser can possibly be, the front lens (next the light) is a thin miniscus for the purpose of collecting rays of light at a wide angle, the middle lens parallelizes these rays, and the back lens can be entirely and instantly removed from the outside, without interfering with either of the other two lenses, or opening the

lantern, or meddling with the jet in any way. Other condensing lenses of different focus, can be instantly substituted to suit any change in the focus of the objective (as is shown in my paper referred to), or when the vertical attachment is to be applied, all that is necessary, is, to remove the back lens of the condenser, and apply the vertical attachment, the mirror of which will receive the practically parallel beam of light emerging from the middle lens, and reflect it upwards to the back lens, which is now placed in its position on the vertical attachment, and thus the rays are condensed in a vertical direction by the same lenses as used in ordinary projection; and the change from one direction to the other, takes less time to perform, than it does to read my description, so, what Mr. Fletcher means by "the necessity for shifting the lime dangerously near to the condenser, and dispensing also with an extra condenser and consequent loss of light," is best known to himself.

It so happens that I gave a lecture, and a number of highly successful physical demonstrations in which the vertical attachment and triple condenser were used, just about the time you were in press with the January number.

W. I. CHADWICK.

The lecture referred to came after we had gone to press last month, but will be found on page 35 of this number.

ED.

CONVEYANCE OF COMPRESSED GAS CYLINDERS.

[To the Editor.]

SIR,—Owing to the revised railway rates, the charges for the conveyance of steel cylinders is particularly heavy by goods train, viz: a minimum of 5/- for conveyance, and 5/- delivery. Protests have been made respecting this, and the matter will no doubt be reconsidered by the railway directors, and brought down to the reasonable amount it was originally, or something near it. Pending this change, all lanternists and users of compressed gas, are advised to send the cylinders by passenger train, for it is possible thus to send 200 miles including delivery for 3/3, as against 10/- by goods train.—Yours truly,

J. H. STEWARD,

406, Strand, W.C.

SITUATION IN THE UNITED STATES.

[To the Editor.]

SIR,—In a recent copy of your journal, I observe among the advertisements that a lantern operator has been advertising that he is desirous of treating with an American firm, respecting obtaining a berth in this country.

The advertiser is evidently unaware that it is against our law for a firm here, to engage labour of any description abroad, and so well is this law known here by both man and boy, that I should be very much surprised if he got a single reply. We employers have a sharp eye on matters of this kind, and should anyone come "across the pond" with an engagement, he would speedily find that the law would take cognisance of his arrival; but if the advertiser were to come here and then look out for and obtain a situation, all well and good.—Yours obediently,

A LANTERN OPERATOR.

Chicago, Ill., U.S.A.

—:o:—

Notes and Queries.

L. J. Kay.—1, You can average the lime light at 450 candle power, but the electric can run into figures that would seem fabulous. 2, The relative cost would be five or six times. 3, It depends upon the candle power you wish to produce. 4, The storage battery.

W. E. Holloway.—No matter whether the lens be a single or a double combination, the table of distances

will suffice. It is the focus only of the lens that has to be considered. If you wish to ascertain the focus of the double combination, allow the image of a distant object to fall on, say a sheet of paper fastened on the wall opposite a window, and when the object is sharply depicted, measure the distance between the paper and half way between the combination of the lens, this distance will be the focus.

Novice.—1, We do not understand your difficulty in connection with vertical attachment. See the last few numbers of this journal, or we shall be pleased to answer definite questions. 2, Remove the objective and bring the light closer to the condenser.

J. C.—You will find the blow-through jet the best to employ until you have had some experience.

J. R. writes: I have an elaborate mechanical slide that is broken, and I have had it at a watchmaker's for repairs, but it does not work properly. Where can I have it seen to? Answer.—We believe that Messrs. Wilkinson of Sunderland make it a speciality of repairing such slides.

F. S. Sharman.—We called upon the firm, and doubtless you will have received your goods long before you see this.

W. Wans.—You will find more hints and information respecting lantern matters, in our back numbers, than in any book published.

P. Brewis.—We did not publish the January Journal on Sunday, although the date January 1st. fell on that day, but on the day previous. Mr. Stevenson recommended blowing through the tubes, before being used a second time in connection with a saturator, as he invariably finds that unless he does so, he has pops and bangs when lighting up.

W. Bird.—The address you require is Gilmer Bros., Manchester Buildings, Cannon Street, Birmingham.

A. E. Salter.—Replied by post.

W. Brown.—The condenser mentioned is good. The gas making apparatus mentioned in last Journal costs about £20, and can be obtained from the M'Intosh, Optical Co., Wabash Avenue, Chicago, U.S.A.

A. Lawson (New Zealand).—1, Use a jet with a smaller bore. 2, Write to Mr. W. Lawson, Rectory View, Newton-le Willow for particulars, or see page 53 of this Journal, for May 1892. We are pleased to hear that you and your friends in New Zealand look upon this journal as a "marvellous pennyworth."

J. Clegg.—Heat applied to the saturator will make a great difference. The pattern you describe is not new, but one of the oldest, you could not expect a proper light with the jet mentioned, use a mixed jet with a medium sized nipple, and let us know how you get on. We have, after using the saturator, put out the light with no more noise than would be caused by a tap of a pencil on a table. You ask if an accident has ever occurred with a saturator; yes, and so have steam boilers exploded under certain conditions, or when manipulated by one not conversant with them.

L. L. G.—Legally you are not allowed to make such slides at all, it is often done for one's private use, but you must not sell them, unless permission is obtained.

One in Doubt.—1, Query came too late for us to ascertain. You can perhaps obtain the information you require from Brin's Oxygen Co., Horseferry Road, Westminster, London. 2, No danger, fitting the tube as you suggest; but the cylinders should be painted different colours.

Prof. De Frere.—1, The general outlet is larger than the oxygen one, subsequently the gas could not mix in the manner you fear and get to the main. 2, If the outer cap or cone is adjustable, screw it a little further on, as the oxygen tube may be rather too far back.

G. W. Smith.—Thanks. We have heard from Mr. G. and intend to write to you shortly upon the subject.